ABSTRACT

A trench MOSFET device and method of making the same. The trench MOSFET device comprises: (a) a substrate of a first conductivity type; (b) an epitaxial layer of the first conductivity type over the substrate, wherein the epitaxial layer has a lower majority carrier concentration than the substrate; (c) a trench extending into the epitaxial region from an upper surface of the epitaxial layer; (d) an insulating layer lining at least a portion of the trench; (e) a conductive region within the trench adjacent the insulating layer; (f) a doped region of the first conductivity type formed within the epitaxial layer between a bottom portion of the trench and the substrate, wherein the doped region has a majority carrier concentration that is lower than that of the substrate and higher than that of the epitaxial layer; (g) a body region of a second conductivity type formed within an upper portion of the epitaxial layer and adjacent the trench, wherein the body region extends to a lesser depth from the upper surface of the epitaxial layer than does the trench; and (h) a source region of the first conductivity type formed within an upper portion of the body region and adjacent the trench. The presence of the doped region lying between the bottom portion of the trench and the substrate (also referred to herein as a "trench bottom implant") serves to reduce the on-resistance of the device.